Systematic Decision-Support Methodology for Resource Recovery

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The promise of recovering valuable resources from waste and process streams of bio-based production processes makes resource recovery one of the pillar technologies in achieving circular economy.

From a decision-making point of view, there are large numbers of technologies that can be potentially employed in the recovery of target resources in a given waste stream, while this decision is further complicated due to the large variation in chemical, physical and biological properties of waste streams that can be encountered. This decision-making process is further complicated by the multi-faceted optimisation and constraints such as technology readiness, process economics and life cycle analysis that can act as road blocks in achieving a successful implementation.

Process systems engineering (PSE) is one promising domain of research that can systematically and efficiently handle these types of large-scale problems. To this end, this presentation will focus on the role of process synthesis can play in efficiently defining and ordering the search space for this type of a large combinatorial problem and introduce a hierarchical, gated multi-disciplinary framework that can be employed to systematically assess the interplay between Technology readiness level, Economics and Environmental sustainability.

The application of the framework is demonstrated through resource recovery examples from bio-based production processes.